3

The economics of shortage in the centrally planned economies

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3.1 INTRODUCTION

The purpose of this chapter is to introduce, and critically review, an approach to the analysis and interpretation of the Eastern European economies largely based on the work of János Kornai and his colleagues at the Institute of Economics, Budapest. Kornai's ideas have been maturing since his early research on the behaviour of the centrally planned, socialist economy, based on Hungarian experience in the mid-1950s (Kornai, 1959). The general aim of his research programme since the 1950s has been to develop a conceptual framework for understanding the functioning of the traditional socialist economy. The main finding, a conception which now forms the central maintained hypothesis of Kornai's school of thought, is that the socialist economy is characterized by endemic and persistent shortage; moreover that this shortage is maintained over time by a variety of mechanisms all grounded in rational behaviour by enterprises, central planners and other agents given their information and expectations, the constraints they experience, and the organizational structures which tie the system together. Some of Kornai's early work is discussed in section 3.2 of the present chapter, to provide the reader with background information on the development of Kornai's thinking. Although Kornai's approach is constantly being developed and refined, both theoretically and through empirical work (some of which is reported later in the book), most of the recent contributions are based on Kornai's own book, *Economics of Shortage* (Kornai, 1980). Accordingly, section 3.3 of the present chapter is devoted to an account of the theoretical model set out in that book.

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The original discussion of shortage-type models was mainly conducted in the context of a static economy, at least in the sense that the growth process was not explicitly modelled. Hence it was easy for critics of Kornai's approach to agree with his analysis and findings as a short-run explanation of certain behaviour and phenomena, while casting doubt on the asserted tendency for a centrally planned economy not only to generate shortage in the first place, but also to reproduce and maintain it over time. It was therefore important to develop more dynamic models in which shortage could occur along an equilibrium path. In a limited way, this was done in some of the contributions to *Non-price Control* (Kornai and Martos, 1981), but a fuller model was provided in *Growth, Shortage and Efficiency* (Kornai, 1982). Both these works are reviewed in section 3.4.

Much of Kornai's analysis is based on a view of the socialist economy quite different in several important respects from that derived from recent Western work on disequilibrium macroeconomics (for examples of the latter, both theoretical and applied, see elsewhere in the present volume). Not surprisingly, therefore, the two approaches have clashed on occasion, and section 3.5 attempts to set out the key differences between them. The remaining sections provide a critical review of Kornai's shortage model (section 3.6), offer an outline of an alernative model of shortage (section 3.7) and finally, in section 3.8, set out some brief conclusions.

3.2 BACKGROUND TO THE ECONOMICS OF SHORTAGE

Kornai has long been a critic of the economic functioning of centrally planned economies. His first detailed study (Kornai, 1959) investigated Hungarian light industry in the 1950s and concluded that the then prevalent extremes of centralization resulted in highly inefficient production, with inflexibility of output, a tendency to hoard input stocks to guard against erratic deliveries, reluctance to innovate, shortages of some goods accompanied by surpluses of others, and so on. Moreover, the internal logic of the centralized system appeared to mean that partial reforms (e.g. reducing the number of plan indicators, simplifying the economic control system, improving incentives at enterprise level) would at best only succeed temporarily, for they would soon be reversed in response to unforeseen difficulties. Such difficulties, however, should more properly be regarded as inherent in the centralized system, rather than as accidental consequences of plan errors. Despite his keen observation of the economic behaviour of Hungarian enterprises, based on very detailed knowledge, Kornai (1959) cannot be said to have developed a complete theory of the centralized socialist economy, though he has some extremely interesting analysis of enterprise/planning hierarchy relationships.

However, in a later work, Kornai (1970) did make some important steps towards a new theory. The first part of that book is a vigorous and trenchant attack on neoclassical general equilibrium theory which, as Hahn (1973b) among others has pointed out, is not wholly compelling because much of the fire-power is directed at the straw man of a highly simplified textbook general equilibrium model. The

second part is more interesting for present purposes, since it develops an analysis of markets and the behaviour of firms in different types of market situation.

For Kornai, markets are rarely, if ever, in equilibrium in the Walrasian sense. Instead, he distinguishes between states of *suction* and *pressure* in the market. The former, which in later work is described as resource constrained, refers to a market situation where on average buyers are looking for sellers, while the latter rarely experience any difficulty in selling what they can produce (and hence have no need to incur substantial marketing costs). This situation can arise even when additional production would be profitable at prevailing prices, if the sellers are also facing supply constraints on their own input markets. Such an allocation, in which agents face constraints in at least two interlinked markets, can form an equilibrium in the sense that no individual agent is able to improve his position given others' behaviour, even though the allocation is clearly inefficient from a social point of view. Thus in this analysis there is no necessary connection between a suitable notion of equilibrium, and efficient resource allocation. An aspect of this in the resource constrained case is that, since firms have no need to seek and attract customers, they are likely to be relatively uninterested in innovation, either in the form of new products (because it is easy enough to sell the established ones) or new processes (because the pressure to cut costs is not especially strong). Hence considered dynamically, an economy experiencing persistent suction in a wide range of important markets can be expected to be a poor innovator, producing mainly traditional goods with outdated technology. Production will often be inefficient and the quality of output low. According to Kornai, this would not be an unreasonable characterization of much of Eastern Europe.

The position is entirely different when markets are subject to pressure, described in later work as demand constrained. These terms refer to markets in which sellers are seeking out and trying to attract buyers, while buyers can typically find what they want without difficulty and may even have a choice between a number of alternative suppliers. At prevailing prices, sellers may be perfectly willing to produce more, and could certainly obtain additional inputs. What prevents them from doing so is quite simply the demand constraint, the inability to sell more. Moreover, suppliers of inputs (labour, intermediate goods) also face demand constraints of their own because of the original constraint. Thus just as for the resource constrained economy, demand constraints tend to occur in a set of interlinked markets, rather than only in a single market. Again, an economy facing such restrictions can settle down into an equilibrium position in which no agent wishes to change his decision given others' decisions, though as before the resulting allocation of resources is not efficient. The allocation that results in this case, associated with unemployment, excess capacity and general underutilization of resources is more familiar when referred to as a Keynesian equilibrium.

While an economy may be obviously inefficient in the short run, Kornai is more optimistic about the long term, dynamic efficiency of an economy experiencing persistent pressure across a range of markets. For, as he emphasizes, when firms have difficulty in selling their goods they have an incentive to engage in activities

that make them more attractive to customers (free delivery and installation, easy maintenance, and generally good consumer service); this also includes innovation to improve product characteristics (appearance, durability, special features, etc.), introduce new products or lower production costs. Thus over a period, a demand constrained economy will provide a relatively varied and up-to-date output mix, and will satisfy customers at least in the fundamental sense that queues, waiting lists and other indicators of shortage conditions will be relatively infrequent. Most of the time the majority of customers will be able to satisfy their requirements in the market, and their economic behaviour will be guided by that expectation.

Many of these ideas have been refined, developed and incorporated into a more consistent and complete model of the economy since 1970, especially in the resource constrained case. Elaborating such a model was the principal task undertaken by Kornai in his *Economics of Shortage*, as we shall see in the next section.

3.3 ECONOMICS OF SHORTAGE

This section outlines the principal arguments of *Economics of Shortage*, generally in a descriptive way, since most critical analysis is deferred to sections 3.5 and 3.6 below. To summarize a massive, two-volume work in a few pages is no easy task, but I shall try to pick out what I regard as the key ideas rather than attempt to précis everything. Given Kornai's experience of living in a centrally planned economy with a great deal of bureaucratic control over production, including strict price controls, it is not surprising that volume A on non-price adjustment should be most interesting for our purposes. However, volume B on adjustment in the presence of prices includes important material on budget constraints and macroeconomic relationships which must also be referred to. Most of the analysis is intended to apply to Hungary prior to that country's 1968 economic reforms, though Kornai argues that shortage conditions (albeit somewhat less severe and general) applied thereafter as well. *Mutatis mutandis* it would apply equally well to the other, still unreformed, economies of Eastern Europe and the Soviet Union.

Concerning the rigour and generality of its analysis, first, it is obvious that *Economics of Shortage* is not a revised version of Debreu (1959) and nor does it pretend to be. In Kornai's words it is a 'descriptive-explanatory theory', rooted in concrete observations of the functioning of socialist economies over many years. It makes no normative claims, and much of the analysis is still partial and incomplete, though in the more mathematical literature a few more general results are available (e.g. Kornai and Martos, 1981). Secondly, throughout the book Kornai seeks to formulate empirically testable hypotheses and is at pains to show how various aspects of shortage-related phenomena could be measured in practice. But he doesn't actually test hypotheses or collect the data needed to measure shortage, so the book is really setting out a major research programme, some initial elements of which have been undertaken since 1980 (see other chapters in the present book).

Firms and households are the principal economic factors in *Economics* of

Shortage, though attention is also paid to the state bureaucracy above enterprise level, especially in connection with investment behaviour and macroeconomic policy. Surprisingly, in view of Hungary's economic circumstances, only passing mention is made of international transactions; in most of the analysis, Hungary might as well be a closed economy.

Since prices are fixed most of the time, agents must respond and adjust to other types of economic signal. Such signals, collectively referred to as quantity signals, include information and observations about stocks, orders, queue lengths, waiting times, the availability of substitutes. Agents also respond to instructions and commands, though usually imperfectly since the combination of real constraints on transactions, and the incentive system prevents exact fulfilment.

In the explanation of shortage, production and the behaviour of firms (including their interaction with other parts of the state bureaucracy) play the leading role, with investment behaviour being the most influential factor. This is not to say that households are irrelevant to the economics of shortage. However, rather than being a fundamental cause of the shortage syndrome, households principally suffer its consequences in terms of queues, forced substitution, unavailable goods and services, and the demeaning relationships between sellers and buyers that prevail in a shortage economy. In short, they experience the substantial welfare losses associated with persistent shortage.

In theorizing about the socialist firm, three kinds of constraint are recognized:

Table 3.1 Key differences between capitalist and socialist firms in respect of the constraints they face

Type of constraint	*Classical capitalist firm*	*Traditional socialist firm*
Resource constraint	Rarely effective	Nearly always effective, more restrictive than demand
Demand constraint	Nearly always effective, more restrictive than resource constraint	Rarely effective
Budget constraint		
Hard	Production plan autonomous: the firm lays it down at the level of demand constraints; within resource constraints	
Soft		Production plan directive prescribed by superior authority at the level of resource constraints; within demand constraints

Source: Kornai (1980, table 2.1).

resource constraints (labour, capital, intermediate inputs), demand constraints (applying to the various outputs), and the budget constraint (finance). Whereas under capitalist conditions it is demand constraints that normally limit production, under socialism it is the resource constraints, hence the terminology of a resource constrained economy. Moreover, whereas a capitalist firm nearly always experiences a hard budget constraint, the corresponding constraint for a socialist firm tends to be very soft. This is why appeals for financial discipline are so widespread throughout Eastern Europe; equally, however, the persistent and institutionalized softness explains why such appeals fall on deaf ears. Table 3.1 shows the key differences between capitalist and socialist firms in respect of all these constraints. Under conditions of shortage (never mind, for the moment, how such conditions came about in the first place), the behaviour of firms and households has a number of important characteristics, which it is simplest to list, with brief explanations.

3.3.1 Shortage and slack normally occur together

In the case of a firm, the typical situation is one where a firm may have adequate supplies of all inputs except one which is in short supply. Since in short run production functions inputs are usually highly complementary, the consequence is a shortage of that particular input and a (hopefully temporary) surplus of others, these surpluses being an example of slack. In an interesting paper, Manove (1973) studied the implications of this kind of complementarity for the economy as a whole using an input–output framework of analysis. He found that the imbalances (shortages and surpluses) showed no tendency to increase without limit, and instead remained within bounds that depended on the pattern of final demand and the technical coefficients: so although resource allocation was inefficient, the economy was certainly viable. For Kornai's analysis, however, the essential point is that in a shortage economy one would expect to observe the simultaneous occurrence of shortage and slack.

3.3.2 Both firms and households engage in forced substitution

Firms use whatever inputs they can obtain to produce output. This output may be of lower quality than desired, or simply involve a different mix of output than had been planned. In either case, households failing to purchase their most preferred combination of goods and services will buy more of what is actually produced. Finally, some of the inputs firms buy may differ from what they originally intended to buy. All these cases are instances of forced substitution.

3.3.3 Characteristic composition of stocks

Whereas capitalist firms tend to hold relatively large and varied output stocks in order to be able to satisfy customers and respond quickly to competition in the market, and hold the lowest possible input stocks in order to keep their costs down,

the opposite is the case with firms experiencing shortage. For such firms can sell virtually anything as soon as it is produced (there is, of course, some unsaleable output, which Kornai refers to as an unproductive slack) and so hold very little output stock. On the other hand, given firms' uncertainties about availability of inputs and their experience of shortages, they tend to demand more inputs than they really need and hoard those that they succeed in getting. The resulting high levels of input stock give firms some protection against poor supplies of other inputs in future periods and also, unofficially, give them something to trade with other firms to get their inputs into the proper proportions. Given suitable statistics on input and output stocks, it would be possible to study the prevalence of shortage by investigating this characteristic stock-holding behaviour. However, shortage is fundamentally a problem of the control sphere (information, regulation etc.) rather than the real sphere (production, transactions) of the economy, since it is always a difference between an intention and a realization. Hence data on stocks can only tell part of the story.

3.3.4 Adjustment without prices

As noted above in a fix-price economy experiencing shortage, the economically relevant signals perceived by firms, households and planners are basically quantity signals: stocks, queue length, orders received, waiting time, and so on. Production does adjust to these signals, albeit with some delay: production of inputs in short supply is raised, resources are directed towards the output of goods for which there are long queues and away from other products. This kind of adjustment occurs both in the allocation of current inputs (e.g. material balances, to formulate the annual plan) and in investment decision-making. One might expect that such adjustments should gradually eliminate an initial shortage situation, but there are several reasons why this does not happen, as indicated in the next three points.

3.3.5 Quantity drive

The central planning systems established throughout Eastern Europe in the late 1940s were modelled on that of the Soviet Union, the main features of which were firmly settled in the 1930s. One such feature was a tendency towards very taut planning, based on the priority allocation of resources to a limited number of key sectors; this feature was certainly transmitted to Eastern Europe. It used to be argued that shortage in Eastern Europe was either the result of accidental errors in planning or a consequence of excessively taut planning on the part of the central authorities. While there may have been some force in the latter view in the early 1950s, Kornai is surely right to stress the need to look beyond such a superficial perspective in order to understand the persistence of shortage in economies where central planning is no longer so taut. Stemming from their experience in the 1950s, the basic motivating force for enterprises is a strong quantity drive, an urge to increase output as far as possible given available resources, and with little regard to cost (see section 3.3.6 below).

The drive stimulates enterprises to demand both current and investment resources, to an extent described by Kornai as almost insatiable demand. To some extent, the demand is tempered by tactical considerations: each enterprise has some idea what level of demand would be considered reasonable by higher bodies and knows that high demands for inputs will only be accepted if a correspondingly higher output target can be agreed on. In addition, if the enterprise claims too much and promises too much in the current period, the demands placed on it in the future will be all the greater, in accordance with the usual bureaucratic principle of planning from the achieved level (the ratchet principle). Despite these reasons for caution on the part of the enterprise, Kornai sees the quantity drive operating at enterprise level as the key driving force behind persistent shortage. In its favour is the fact that both managerial rewards and an enterprise's strength in the usual plan-bargaining process are likely to be enhanced by the achievement of larger size: quite literally, 'big is beautiful' in the socialist world.

3.3.6 Soft budget constraint

What makes the quantity drive possible for enterprises is the softness of the budget constraints under which they operate. Four conditions contribute to the softness of the constraint for a state enterprise, which may hold to different extents in different countries or at different times: these are (Kornai, 1980, pp. 306–9):

1. price-making, in the sense that sooner or later enterprises are able to impose cost increases on their customers
2. soft tax system, with enterprises able to negotiate special rates or exemptions, or influence the formulation of tax rules
3. free state grants available to enterprises for a variety of purposes
4. soft credit system, with loans only loosely related to future sales revenue and with only mild repayment conditions and/or weak penalties for non-repayment

Obviously, under these conditions, the survival of a firm is hardly at all contingent on its ability to cover all its costs out of its sales proceeds since grants, subsidies, tax favours etc. can be negotiated to fill the gap. Likewise, growth of the firm does not depend only on internally generated funds supplemented by hard loans, but can be supported from a variety of softer financial means. State enterprises in this kind of environment are also not obliged to react to price changes as one would expect a capitalist firm to do. They may react by changing input combinations, or production, (real sphere), but they may just as well negotiate a special tax regime or exemption from a credit repayment obligation with a higher authority (control sphere).

Furthermore, enterprises with soft budget constraints face a special kind of uncertainty. Although survival is virtually assured (no bankruptcy), an enterprise can never be sure that it will be allowed to keep and use any additional funds that it manages to accumulate. There is an ever-present risk that surplus cash may be siphoned off to help out other enterprises in a less fortunate situation.

Consequently, whenever enterprises have financial resources, or see the possibility of getting them, they will go all out to spend and commit the funds as quickly as they can: hence the almost-insatiable demand referred to above. To sum up the soft budget:

> The soft budget constraint – as opposed to the hard one – is unable to act as an effective behavioural constraint, but exists only as an accounting relationship (Kornai, 1980, p. 309).

3.3.7 Control by norms

In the light of these observations, we are now ready to sketch the adjustment mechanism of a shortage economy, to explain how shortage may be reproduced, rather than be eliminated by the adjustments described in section 3.3.4. The essential notion is that of a norm. One aspect of a norm is simply an intertemporal average of some economic variable. However, not all such averages can be regarded as norms. A norm has the additional feature that any departure of the economy from the normal value of the variable(s) in question sets up a behavioural response – on the part of households, firms, central agencies – tending to restore the normal state. This mechanism is called control by norms. Similar mechanisms can be envisaged, and are discussed by Kornai, in which the control process is governed by upper and lower acceptance limits of some economic variable, but the basic idea is much the same.

If shortage becomes a regular, practically institutionalized feature of an economy, then a normal degree of shortage can become established, in the above sense. Then if for some reason shortage becomes more intense, central authorities are likely to receive more complaints about poor quality and unavailable goods. They can react by diverting goods from exports, by restricting investment, by concentrating investment on factories producing those goods in most severe shortage, by raising prices (though this will only be effective for households, and is politically hazardous), and by cutting back on input deliveries to sectors/enterprises not producing shortage goods. Sooner or later, a combination of central measures of this kind will cut back the shortage intensity to an acceptable level and the economy can return to the more routine regulation and resource allocation of the centralized model.

This is a sketch of a possible centralized mechanism whereby a given and established normal intensity of shortage can be reproduced over time through control by norms: it does not, of course, explain how that shortage intensity came to be the normal one. But in some ways more interesting is Kornai's demonstration that a variety of decentralized mechanisms can achieve the same result. Here we merely set out one such mechanism, based on stock and order signals. In this case the model is a multisector Leontief model, and the norms concern input stocks, output stocks and the backlog of unfilled orders. Four equations define the model, two of which represent resource balances, two of which are behavioural. The first

two are balance equations for input and output stocks respectively:

$$\dot{v}_{ij} = Y_{ij} - a_{ij}X_j \qquad i,j = 1,2,\ldots m \tag{3.1}$$

where Y_{ij} is purchase of good i by branch j, a_{ij} is the usual input coefficient and X_j is gross output (here we are using the normal notation employed in input–output analysis); and and v_{ij} is the input stock of good i held by sector j (as usual, a dot denotes differentiation).

$$\dot{U}_i = X_i - \sum_{j=1}^{m} Y_{ij} - f_i \qquad i = 1,2\ldots m \tag{3.2}$$

where U_i is the output stock of good i held by producers, f_i is sales to households (Kornai, 1980, p. 139).

The control sphere of the model is represented by two equations; one describes firms' purchases of inputs:

$$\dot{Y}_{ij} = a_{ij}\dot{X}_j - 2\theta\lambda\dot{v}_{ij} + \lambda^2(v^\circ_{ij} - v_{ij}) \qquad i,j = 1,2\ldots m \tag{3.3}$$

where θ, λ are control parameters. In words, this states that firms purchase more inputs if output has increased, input stocks have fallen, or actual input stocks are below their desired levels, v°_{ij}. The second control equation concerns the adjustment of production,

$$\dot{X}_i = \sum_{j=1}^{m} \dot{Y}_{ij} + \dot{f}_i - 2\theta\lambda\dot{U}_i + \lambda^2(U^*_i - U_i) \quad i = 1,2\ldots m \tag{3.4}$$

where $U^*_i$is the norm for output stocks. Thus output is increased when sales to other firms and to households have increased, when output stocks have declined, and when actual output stocks are below their normal level (Kornai, 1980, pp. 140, 141).

The system defined by Equations 3.1–3.4 has a unique normal state in which household demands are satisfied and $v_{ij} = v^\circ_{ij}$, $U_i = U^*_i$. Moreover, if the system is disturbed it is stable: the control mechanism drives it back to the normal state. Finally, a similar model with order backlogs instead of stock signals has the same properties and Kornai conjectures that a mixed system (with both types of signal) would be similarly well behaved. To sum up, control by norms is both viable and stable, and the normal state may well be quite distant from the more familiar Walrasian equilibrium.

The above control mechanism is decentralized in the sense that it uses entirely decentralized information which each firm/sector can observe for itself, and each sector makes its own decisions independently of what others have decided. In a model with order signals there is also some horizontal communication of information. But in both cases, this kind of control is described as vegetative control. Thus what Kornai has shown here is that a decentralized economy can function adequately in the absence of price signals, through the operation of vegetative control, and that this control mechanism permits a state which may be characterized by a high degree of shortage continually reproduced. Kornai

suggests that in a more complex control system with strong vertical information flows (e.g. plan instructions), the vertical flows are superimposed upon an underlying vegetative control mechanism; also that in post-reform Hungary, where plan instructions are greatly diminished but the market remains weak, the role of vegetative control is much increased.

3.3.8 Friction

All economies contain elements of friction, phenomena that impede or introduce errors and uncertainty into processes of economic adjustment. In a very general way, it makes sense to think of a tripartite relationship between intensity of shortage, η, productive slack, λ and some measure of friction, ε:

$$\eta = \phi(\lambda, \varepsilon) \tag{3.5}$$

(Kornai, 1980, p. 161 and elsewhere).

Such friction functions, as Kornai calls them, can arise in a number of different ways: for example, imperfect information on the part of buyers or sellers, volatility of demand, delays and rigidity in sellers' adjustment. In most cases, the notion of friction seems to arise in situations where agents have some difficulty (have to incur some costs) in coming together to effect a transaction either because of uncertainty, or because of poor and/or costly information. Thus the idea is analogous to the concept of transactions costs which has been developed in a number of partial models in Western economies, though not yet properly integrated into Walrasian general equilibrium theory (Williamson, 1986; Ulph and Ulph, 1975). The other aspect of friction has to do with change, and resistance to it on the part of one or more agents, usually firms. This has to do partly with the simple point that no-one likes to change what they are used to doing, and a firm operating with a relatively soft budget constraint is not under the same pressure to change that a capitalist firm

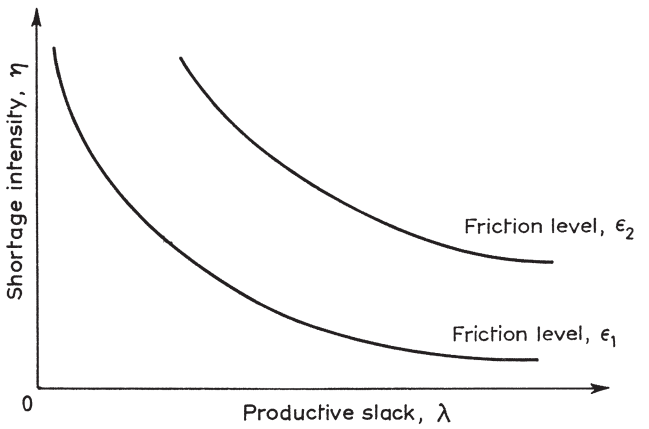

Fig. 3.1 Typical friction function: $n = \phi(\lambda, \varepsilon)$

would be. But also, it reflects the fact that change frequently involves real resource costs and may therefore be resisted on that account too.

In all the examples presented by Kornai, the friction function takes the following simple form. From Fig. 3.1 it is clear that for any given level of friction in the economy, shortage intensity and productive slack are inversely related. And as friction increases from ε_1 to ε_2, the whole curve shifts outwards, away from the origin.

All three variables involved in the friction functions, η, λ and ε, should be measured by means of vectors of suitably chosen indicators, so

$$\eta = f_1(\mathbf{Z}), \quad \lambda = f_2(\mathbf{q}) \quad \text{and} \quad \varepsilon = f_3(\mathbf{W}) \tag{3.6}$$

where $\mathbf{Z}$ and $\mathbf{q}$ are vectors of shortage and slack indicators respectively, $\mathbf{W}$ is a vector of indicators of friction. In practice, as suggested previously, the aggregation implied by Equation 3.6 may involve losing too much information, and functions of this kind may have to be specified separately for a number of partial markets.

3.3.9 Investment and innovation

Within a centrally planned economy, the institutional framework through which investment is determined involves the central planning office, branch ministries, banks and the ministry of finance, other central agencies (e.g. ministry of foreign trade if imported machinery is required), and the enterprises themselves. At national level, both in five year and annual plans, the real and financial resources available for investment are identified or estimated and either parcelled out according to a preassigned sectoral division, allocated to specific major projects, or left unallocated initially but made available to support enterprises' and their superiors' own investment proposals.

In principle, approved projects (whether state or enterprise initiated) have to satisfy appropriate investment criteria which are similar, at least in recent years, to those recommended in Western countries (on investment in Hungary, see Hare (1981); on the Soviet Union, Dyker (1983)). Nevertheless, despite the clear structure for determining the level and pattern of investment, and the need for individual projects to satisfy economically rational criteria, centrally planned economies persistently suffer from shortage which extends into the sphere of investment. Moreover, as emphasized earlier, the problem is at most only partly explained by taut planning imposed from on high since, to a large extent, plan tautness is nowadays a consequence of the prevailing normal intensity of shortage rather than an independently chosen variable.

The same quantity drive that we discussed above, becomes, in the investment context, an expansion drive. Virtually all socialist enterprises wish to initiate and undertake investment projects to expand their scales of operation and because of their soft budget constraints they are not normally restrained by fears of loss or failure. Although there is some self-restraint for tactical reasons, the demand for investment is almost insatiable and is highly insensitive to price-type instruments

such as the rate of interest. Even after the Hungarian economic reforms, budget constraints remained soft and so the same mechanism continued to reproduce investment tension.

Shortage has a number of specific manifestations in the investment sphere. First, project appraisal using approved criteria becomes almost a meaningless exercise because investors do not bear any serious responsibility for losses and evaluators lack reliable information: hence the widespread use of formal criteria tells us almost nothing about real investment efficiency. Also, the existence of shortage is often used as a justification for investing in some field, while its absence can be a reason for postponement. Second, since investment resources can be spread more or less thinly, it is easy for higher authorities to approve too many projects without (initially) realizing the probable effects: longer than planned completion times, cost overruns. Third, enterprises wish to expand, but preferably wihout disrupting current production, so scrapping rates are inefficiently low. Fourth, the structure of investment becomes extremely rigid, partly because in any given year a very high proportion of the available resources is devoted to continuing work on already committed projects, and partly because competition for resources among the central agencies tends to repeat resource shares established in earlier periods. Lastly, a consequence of these points is that enterprises are commonly unwilling to undertake innovation of a particularly fundamental kind since they can easily convince themselves, within the established framework of constraints and opportunities, that a more conservative investment policy would be quite adequate.

Once a normal degree of investment tension has become established, the centrally planned economy's adjustment mechanisms will generate a cyclical path of development around the norm. For detailed empirical studies of this type of process, see the monumental work of Bauer (1981), as well as Soós (1975, 1983).

Overall, therefore, this approach to the analysis of a centrally planned economy under conditions of shortage accounts for many of the features of economic behaviour in such economies which have commonly been attributed to irrationalities or accidental errors on the part of planners or lower organs of regulation. Quite the contrary, shortage and its associated phenomena must be regarded as a perfectly logical outcome of rational economic behaviour under suitable conditions. Let us now, in the following section, investigate some of these phenomena in a more dynamic context.

3.4 SHORTAGE IN A GROWING ECONOMY

In *Non-price Control* (Kornai and Martos, 1981), Kornai and Simonovits prove some results about the normal path in a von Neumann model of the economy. Such a path, with control by stock signals, is shown to be stable and viable under suitable conditions, the model being essentially that of section 3.3.7 above. Similar results are obtained for a model with order signals. But neither of these models is truly dynamic in the sense of incorporating growth in the supplies of primary

factors of production, notably labour and capital. However, one might suspect that a model which also dealt with the factor markets properly would no longer exhibit persistent shortage. Initial shortage should be alleviated and eventually eliminated altogether by increases in factor inputs. The objective of Kornai (1982) is to demonstrate that this view is incorrect, and that shortage can persist even in a growing economy in which the supplies of capital, labour, the level of output, incomes and living standards are all regularly increasing.

The model is a closed, linear macroeconomic model without money, with firms, households and a labour market. It is set out in a detailed version, with 26 mainly linear or linearized equations (11 describing the real sphere, 15 describing the control sphere), but can also be compressed into a set of six equations in six fundamental variables. The compressed version of the model is useful for the mathematical analysis of growth paths, but is not very convenient from the point of view of economic interpretation. Accordingly we focus here on the detailed model but only cover certain aspects of it, because of space limitations. Throughout, the price level is assumed to be given and fixed, though it would be interesting to rework the analysis with a varying price level.

The first key equation explains actual shortage, as measured by a suitable macroindex, as:

$$Z(t) = Z^*(t) + a_K[K(t) - K^*(t)] - a_u[U(t) - U^*(t)] - a_V[V(t) - V^*(t)] + a_Z[Z(t-1) - Z^*(t-1)] \tag{3.7}$$

where

$K(t)$ is the economy's investment commitment at time t
$U(t)$ is the input stock held by firms
$V(t)$ is the corresponding output stock

and an asterisk denotes a normal value (Kornai, 1982, p. 24). Thus Equation 3.7 indicates that shortage is greater if investment commitments are above normal, or if stocks are below normal, of if shortage was relatively intense in the previous period.

The prevailing shortage then affects the demands of households and firms. Thus for households:

$$H(t) = H^*(t) - b_Z[Z(t) - Z^*(t)] \tag{3.8}$$

and for firms:

$$Y(t) = Y^*(t) - c_V[V(t) - V^*(t)] - c_Z[Z(t) - Z^*(t)] \tag{3.9}$$

where

$H(t)$ is household purchases of goods and services (aggregate commodity)
$Y(t)$ is the firms' purchases

and other notation is as above (Kornai, 1982, pp. 27, 30). Then production,

$$X(t) = X^*(t) - d_u[U(t) - U^*(t)] + d_Z[Z(t) - Z^*(t)] \tag{3.10}$$

Normal production,

$$X^*(t) = p(t)N(t) \tag{3.11}$$

where

$p(t)$ is standard productivity at t,
$N(t)$ is actual employment

(this equation is one of only two remaining nonlinearities in the model) (Kornai, 1982, p. 31).

To simplify the treatment of investment it is assumed that project gestation periods are fixed and constant at G years, that the economic life of all projects is T years after construction and that spending on any project takes place according to the fractions $\beta_i (i = 1, 2 \ldots G)$ in year i of the construction period ($\sum \beta_i = 1$, of course). With these assumptions, the investment commitment at t (i.e. the resources required to complete all projects approved before date t),

$$K(t) = \sum_{\theta=0}^{G-1} \sum_{t=\theta+1}^{G} \beta_t M(t-\theta) \tag{3.12}$$

where

$M(t)$ is the volume of the tth investment vintage, i.e. the spending estimated to be necessary to complete all projects started at date t.

Then the control equation of the investment process takes the form:

$$\begin{aligned} M(t) = M^*(t) &+ e_{\mathrm{H}}[H(t-1) - H_{\mathrm{p}}^*(t-1)] - e_{\mathrm{K}}[K(t) - K^*(t)] \\ &- e_{\mathrm{Z}}[Z(t) - Z^*(t)] \end{aligned} \tag{3.13}$$

where the only notation not yet established is $H_{\mathrm{p}}^*(t)$, which represents the normal, or planned value of consumption from the standpoint of the central agencies; it may differ from $H^*(t)$ referred to in Equation 3.8, which is the normal value of consumption from the households' point of view (Kornai, 1982, p. 44).

What Equation 3.13 says is that the volume of investment will be raised if consumption is higher than normal, if investment commitments are below normal, or if shortage is below its normal value. Thus three separate non-price indicators influence the fluctuations and growth in $M(t)$ about its normal value $M^*(t)$. Notice that, in contrast to the theory of investment in a capitalist economy, none of these is closely related to the expected future demand: socialist firms expect to be able to sell whatever they can produce, so investment is rarely constrained from the side of demand. In addition, the financial state of enterprises (their current or prospective profits) has almost no effect on investment under socialism, so such factors are also omitted from Equation 3.13 (see also section 3.6.2 below).

Each vintage is associated with a demand for labour,

$$J(t) = fg^t M(t) \quad 0 < g < 1 \tag{3.14}$$

where f is a constant and $(1 - g)$ measures the rate of fall of the labour requirements

per unit of investment. (Kornai, 1982, p. 42). Then total labour demand,

$$L_D(t) = \sum_{\theta=G}^{T+G-1} J(t-\theta) \tag{3.15}$$

and in the *extensive* growth version of the model, this in turn equals actual employment, $N(t)$ (Kornai, 1982, pp. 54, 55). In the *intensive* growth version of the model, the labour market also experiences shortage and so the labour market has to be modelled somewhat differently. However, that need not detain us here. The important point to note is that Equations 3.14 and 3.15, together with 3.16 and 3.11 establish a connection between investment and subsequent output, via employment creation.

The equations presented so far fall well short of a complete statement of this dynamic model, but they are sufficient to illustrate its general structure, and show some of the main relationships. What is given above has to be supplemented with resource balances, a wage equation, a productivity equation and a variety of other items in order to close the model.

If the various normal values in the model grow at compatible (in most cases, identical) rates over time, then it can be shown that this model:

1. has a normal path along which consumption, investment, output, etc., grow at constant rates, maintaining a constant (in relative terms) intensity of shortage;
2. follows a growth path which fluctuates around the normal path if the model is not already established in its normal state; for small deviations from the normal path, the normal path is asymptotically stable.

This means, therefore, that economic growth, with capital accumulation and improving living standards, is perfectly compatible with persistent shortage. There is no necessary connection between living standards and the intensity of shortage, though it is obviously the case that a high intensity will impose substantial welfare losses on consumers – queueing, delays, forced substitution, search – as they seek to achieve the established standard of consumption. Such costs are not directly allowed for in the model, though their effects are picked up through the impact of shortage on other economic variables.

3.5 CONTRASTS BETWEEN ECONOMICS OF SHORTAGE AND THE DISEQUILIBRIUM APPROACH

In *Economics of Shortage* as well as in his earlier work, Kornai has been at pains to distance himself from Walrasian general equilibrium theory and the more recently developed constrained equilibrium models derived from this theory through the work of Clower, Barro, Grossman, Malinvaud and others, and in its application to Eastern Europe, the work of Portes and his associates (see elsewhere in the present book for more details about this approach). It is all too easy, though in my view it would be a serious mistake, to dismiss this as mere product differentation for, as

Table 3.2 Points of difference between constrained equilibrium and shortage models

Feature	*Constrained equilibrium*	*Shortage*
(1) Excess demand	Uses the concept	Rejects the concept or uses with extreme caution
(2) Behaviour of firms	Profit maximizing (hard budget)	Quantity drive (soft budget)
(3) Stability of equilibrium	Dynamic behaviour not usually discussed	Control by norms; interested in existence, reproduction and stability of an equilibrium with shortages.
(4) Explanation of shortage	Incorrect relative prices	Non-price behaviour of firms and planners
(5) Micro and macro interactions	Only through aggregation; no behavioural link	Macro states affect agents' expectations, hence micro behaviour

should be clear from the last two sections, Kornai's analysis departs from the Walrasian framework in several important ways and is not just a minor variant on the same theme. For the moment, let us simply summarize the principal differences between constrained equilibrium models and what we may call (Kornai's) shortage models.

For convenience and as a guide to our subsequent discussion, these differences can be grouped into five broad categories: excess demand; the behaviour of firms; the stability of equilibrium; the explanation of shortage; interactions between micro and macro outcomes. Table 3.2 summarizes the key points that we need to discuss, in relation to these categories.

For economists brought up in the Walrasian tradition, the notion of excess demand is familiar, straightforward and reasonably unproblematic; but for Kornai it is misleading and confusing, because of the way in which it aggregates economic information illegitimately. Consider the following simple example, concerning a market for a single product. Suppose firm i offers supply y_i on to the market $(i = 1, 2, \ldots, I)$ and household h demands a quantity $X_h (h = 1, 2, \ldots, H)$. Let total supply be y, and total demand X. Then according to the conventional definition, excess demand,

$$Z = X - y \tag{3.16}$$

A more detailed story would be along the following lines. Household h may find that it is only able to purchase an amount $\bar{X}_h$, which may be strictly less than X_h; it would then be proper to say that household h experiences (partial) shortage if excess demand,

$$Z_h = (X_h - \bar{X}_h) > 0 \tag{3.17}$$

Combining these gives us a vector of shortage indicators, $\mathbf{Z} = (Z_1 \ldots, Z_H)$. Similarly, firm i may find that it can only sell $\bar{y}_i$ which may be less than y_i. If the firm has actually decided to produce y_i and has the resources to do so, then it may accumulate stocks, a form of slack. The amount of such slack at firm i, is

$$q_i = (y_i - \bar{y}_i) \tag{3.18}$$

and again we can form a vector of these slack indicators, $\mathbf{q} = (q_1, \ldots, q_I)$.

Now, of course, if x_h and y_i represent actual transactions, as we have suggested, then

$$\sum_h \bar{x}_h = \sum_i \bar{y}_i \tag{3.19}$$

and

$$Z = \sum_h Z_h - \sum_i q_i \tag{3.20}$$

where Z is the notion of excess demand defined in Equation 3.16. Kornai's point, in this context, is that it is frequently illegitimate to carry out the aggregation entailed in Equation 3.20. This is partly because the behaviour of any given market is likely to depend in important ways on both shortage and slack indicators, partly because not all market participants will have the same experience (the short-side rule may not hold), and partly because the usual aggregation required to obtain the Walrasian excess demand imposes unduly stringent requirements on market information.

On the behaviour of firms, Kornai argues that neoclassical theory is inappropriate for a socialist economy. In the neoclassical theory, firms maximize profits at given prices subject to remaining within their respective production possibility sets. The only difference that occurs in constrained equilibrium models is that firms have to solve this problem in the presence of additional constraints resulting from rationing or other restrictions on the set of feasible transactions. But to the extent permitted by the constraints, they still seek to produce any given output vector at minimum cost, and to produce a profit maximizing output vector too.

In Eastern Europe, however, the bulk of production has been nationalized and subject to highly centralized state planning since 1950, with an emphasis on increasing output as rapidly as possible and with little reliance on price-type market signals to guide resource allocation. It would be wrong to blame all the mistakes of Eastern European planning on this expansionary pressure from above, since the resulting quantity drive (to use Kornai's illuminating terminology) has now been internalized by enterprises themselves, and persists even in post-reform Hungary. This is so despite the fact that in most of the region, some measure of profit has been one of, and in some cases, the leading indicator of enterprise performance since reforms were introduced in the 1960s.

The implication of this is that the approach to modelling an enterprise functioning in a socialist economic environment must be substantially different from the familiar profit maximizing story of a capitalist firm.

The third point in Table 3.2 concerned the stability of equilibrium. In Walrasian theory, as well as in the newer constrained equilibrium models, the focus is on equilibrium: the characterization of such states and then demonstrating that a given model possesses at least one equilibrium. Relatively little attention is paid to out-of-equilibrium behaviour, not least because it is extremely difficult and quickly runs into apparently insurmountable problems, as argued for instance in Arrow (1959) and Hahn (1973a). Moreover, even the stability analysis that has been done (see Arrow and Hahn, 1971; Fisher, 1984) mainly concentrates on the so-called tâtonnement case in which no transactions take place until the equilibrium has been found. Only a few results are available in non-tâtonnement stability analysis, for although it is clearly more realistic to allow transactions to occur while the economy remains out of equilibrium, models allowing this have not proved especially tractable.

Contrary to what he would usually concede, Kornai himself is principally interested in the characterization of equilibrium positions, in his case equilibrium with shortage. As always, equilibrium is a state at which effective demands and supplies are equalized in every market, and where no agent can achieve a better allocation for himself through his own actions, in view of the prevailing real and perceived constraints. An equilibrium with shortage, therefore, is one in which on average agents perceive supply constraints in the markets that concern them, the constraints occurring both in output markets and in the markets for factors and intermediate inputs.

Where Kornai departs from equilibrium analysis is when he seeks to explain and describe the mechanisms according to which a state of shortage can be maintained and reproduced over time, not through errors of planning but through the rational behaviour of economic agents interacting together under specific conditions. This requires him to consider what happens when an economy with shortage is disturbed: will it gravitate towards the (or a) Walrasian equilibrium, or is it possible to identify economic forces and feedback loops through which the economy will be restored to an equilibrium with shortage? Under the socialist conditions taken for granted throughout his analysis, Kornai argues that there will indeed be forces tending to reproduce a shortage equilibrium, to explain which he invokes such concepts as normal shortage, normal slack and control by norms, as we saw in sections 3.3 and 3.4. The approach is at once powerful and problematic: powerful, in that it yields the results Kornai wants; but problematic, in that, as I pointed out in an earlier paper (Hare, 1982), it seems to imply that equilibrium is what agents expect it to be. In common with other bootstrap approaches to equilibrium (e.g. Hahn, 1982), it opens up a serious possibility of multiple equilibrium; we discuss this further in the next section.

On the fourth point in Table 3.2, constrained equilibrium and shortage models offer very different explanations of shortage. In the former, shortage is a consequence of certain configurations of relative prices (and hence can be remedied merely by bringing about appropriate adjustments in these prices), while in the latter prices are at most a supplementary factor. Other factors, as we have seen,

include the institutional framework within which production decisions are taken, the softness of budget constraints and the persistent quantity drive.

A great deal of the recent work on constrained equilibrium models has had the objective of providing a coherent microfoundation to Keynesian macroeconomics, e.g. the survey in Weintraub (1979), Muellbauer and Portes (1978), Barro and Grossman (1976) among many others. The approach is synthetic, in that it explains macroeconomic magnitudes entirely in terms of an aggregation of individual behaviour, but there is usually little or no feedback from macroeconomic states to the behaviour of individual firms and households. Moreover, vigorous application of the short side rule and the usual assumption of identical preferences means that one might as well (with very little loss) restrict attention to models with a single household and a single firm, as is sometimes done. At this point, however, it is surely pertinent to ask what has happened to the microfoundation, though one could still discuss this in terms of optimal behavioural rules.

In contrast, Kornai's notion of a normal state recognizes explicitly that the behaviour of individual agents (firms or households) may be conditioned by their appreciation of the macroeconomic environment in which they operate. To use the terminology of Hahn (1973a), some expectations about shortage form part of every agent's theory of the economy in a centrally planned economy; more important, these expectations are likely to affect behaviour even if particular agents are not currently experiencing shortage on the markets in which they currently wish to trade. Thus, while Kornai can hardly reject the straightforward use of aggregation to form macroeconomic quantities (like consumption, output, employment) from individual agents' behaviour, he would also insist on a causal link in the opposite direction which has not often been taken into account in constrained equilibrium models.

Aside from their usual failure to allow for the simultaneous occurrence of shortage and slack, either in individual markets or in aggregate, Walrasian models also typically neglect frictions in the economy. Using the notation introduced in section 3.3.8, Kornai therefore characterizes a Walrasian equilibrium as that state of the economy in which

$$Z = 0, \quad q = 0 \quad \text{and} \quad W = 0 \tag{3.21}$$

i.e. no shortage, no slack and no friction. While formally correct, it is not hard to see this to some degree as a straw man set up by Kornai only to knock down. For there is certainly no real economy in which all conditions are satisfied simultaneously (3.21), but even the most ardent neoclassical theorist is well aware of the fact and would readily concede that some resources are absorbed by frictions of various kinds. However, in neoclassical models such frictions have no effect on the fundamental behaviour of economic agents, while Kornai's important point here is that frictions do affect behaviour.

In the terminology of Hahn (1973a), for a Walrasian equilibrium, agents must hold a theory of the economy according to which their own decisions will not influence

market prices (price-taking) and in which they do not expect to encounter shortages, or experience the inability to sell output or factor supplies, in the normal course of business (supply = demand); this does not exclude occasional and temporary shortages and surpluses since these will be insufficient to oblige agents to modify their theories, nor does it exclude the absorption of some resources to deal with friction in the economy. Consequently, Kornai's assertion of Equation 3.21 is an overstatement of the requirements for Walrasian equilibrium. However, in the context of his own theory this is in any case a side issue, for he is principally concerned with economies in which agents expect to, and actually do encounter constraints on their transactions, so any agents foolish enough to adopt the Walrasian conjecture would quickly have it falsified by experience. This is one of the important factors distinguishing Kornai's theory from the Walrasian model of general equilibrium, though the treatment of friction is also a significant difference as we have seen.

However, part of the reason Kornai's emphasis on the differences between his approach and Walrasian theory can be found in another direction. This is that *Economics of Shortage* is devoted to explaining not only the existence and features of normal states with shortage, but also as we saw in section 3.3.7 above, the dynamic behaviour of an economy when disturbed from a normal state, where Walrasian models almost invariably focus on equilibrium states alone. Such dynamic behaviour involves changes in economic decisions by both firms and households, in response to whatever signals are included in a given analysis, and hence the account of friction given earlier arises quite naturally. At the normal state itself, agents no longer seek to change their decisions and everyone has found partners to carry out those transactions which are feasible: hence once such a state has been established for some time, logically, friction should drop to zero. But in an economy that is constantly changing this situation is hardly likely to occur and friction will remain an essential and significant feature of economic adjustments, as Kornai quite properly emphasizes.

Moreover, according to a less rigid interpretation of the normal state, perhaps closer in spirit to Kornai (and possibly also to Hahn, 1973, interestingly), even at the normal state micro-level transactions will be changing as shortages affect varying inputs at different firms; again, it would be wrong to neglect friction in this situation.

Philosophically, the approach outlined here is not far removed from that of the Austrian school (see Kirtzner, 1973, for example; and in the context of debates about planning, Lavoie, 1985) which treats the market as a process and price signals as stimuli to economic change. Although we are not so interested in price signals in this chapter, the Austrian emphasis on dynamic aspects of markets is clearly analogous to the adjustment processes going on in centrally planned economies experiencing shortage, as described and modelled by Kornai. The processes described by the latter for a planned economy are not, however, so benign as the market processes described by the Austrians are supposed to be: in particular, socialist enterprises are less interested in innovation.

These points also have major implications for the conduct of empirical work. As is made clear elsewhere in this book, empirical studies based on Barro–Grossman models incorporate 'min' conditions and admit several types of equilibrium within any given model. Hence estimating the model simultaneously identifies the equilibrium regime or regimes existing at various times. In particular, as Portes and Winter (1978) sought to show, one can conclude that shortage conditions (equivalent to repressed inflation in their approach, though not for Kornai) existed in some years though not in others. Kornai has expressed a good deal of scepticism about this kind of conclusion. Empirical work based on his approach can either endeavour to measure shortage (an aspect discussed later on) or it can estimate all or parts of the economic control mechanisms that reproduce shortage, as in some of the work on investment of Lackó (1986). In either case, there is a working assumption that shortage conditions are present, and only if the estimation failed very badly would one question the validity of that assumption.

3.6 CRITICAL REVIEW OF THE SHORTAGE MODEL

In this section, I select for detailed discussion a few issues related to Kornai's models of shortage. The issues are chosen either because they are helpful in locating Kornai's theories in relation to other work, including the constrained equilibrium models examined elsewhere in this book (and in section 3.5 above); or because they point to problematic aspects of his approach; or finally, because they are important from an empirical standpoint. The selected topics are: the nature of equilibrium; the soft budget constraint; and the measurement of shortage under various conditions.

3.6.1 The nature of equilibrium

From the Barro–Grossman analysis of fix-price macroeconomic models it is well known that particular constellations of prices are only compatible with particular types of equilibrium. For example, Keynesian equilibrium can only occur while prices lie in a certain region of the price space and repressed inflation equilibrium can only occur in another, normally disjoint region. If the household sector contains more than one household and income effects are significant, multiple equilibria are possible and it is even quite easy to construct cases for which different types of equilibrium are compatible with the same price vector, e.g. Hare (1982). Similarly, if goods and/or labour markets are disaggregated, multiple equilibria also become more likely. But in all these situations, there is a well-defined correspondence from price vectors to sets of equilibria, the correspondence depending entirely on the shape of the underlying utility and production functions.

For the shortage equilibria that arise in Kornai's analysis, the position is completely different. On the one hand, prices seem not to matter at all and play no active role in most of the discussion, while on the other hand the equilibrium itself seems to be determined entirely by what agents expect it to be, as reflected in the

norms of the system (i.e. normal shortage, normal input and output stocks, etc.). This is most clear in the formal models of sections 3.3.7 and 3.4 above, in which normal shortage, Z^*, is an exogenous variable. If agents (notably firms) expect shortage to be very intense (high Z^*) then in equilibrium it certainly will be and everyone is proved correct. Equally, with an identical structure but a general expectation of a low intensity of shortage, that is how things turn out. Hence in these models we have multiple equilibria with a vengeance, for equilibrium can be practically anything we choose it to be. What the models actually tell us is twofold: first, that Kornai's story of a shortage economy is consistent in the sense that formal models with shortage equilibria can be constructed; and second, that the equilibria in such models are stable as a result of the feedback control mechanisms built into them.[1] Thus once established, shortage can be reproduced over time, as Kornai argued. However, the formal analysis does not indicate how shortage emerges in the first place, nor why the normal intensity of shortage comes to have a particular value.

This implies, therefore, that the mathematical models do not explain shortage, but only its reproduction. Yet Kornai is insistent that shortage is indeed the state that occurs in practice, so something must be missing from the models. The missing factor must have something to do with the quantity drive or expansion drive of socialist enterprises which, in conjunction with the ever-present soft budget constraint, are what generate shortage conditions, according to his arguments. Yet in the model of section 3.3.7 there is nothing that can be attributed to a quantity-drive *per se*; the absence of prices and financial constraints from the equations is surely not enough. Furthermore, the situation is no better in the dynamic model of section 3.4, since this also fails to model carefully the particular factors said to generate shortage. However, it is important to emphasize that these deficiencies are only shortcomings in the modelling. In his more descriptive analysis of shortage economics Kornai certainly pays attention to the historical/institutional factors which generated shortage in the first place. Moreover, in view of the limited powers of the planners and the strength of autonomous processes in the economy, even the role of expectations may be less dramatic than the formal models would imply. It may not be easy to make firms believe that normal shortage has fallen.

The distinction between the equilibria arising in *Economics of Shortage* and those occurring in the Barro–Grossman analysis can be brought out more forcibly if we consider their respective policy implications. In the latter case, policy recommendations would tend to focus on the price structure: thus if the economy is stuck in a repressed inflation equilibrium, one would normally advise measures to raise prices and money wages, while reducing the real wage. Such measures would be effective in the consumer goods sector in a socialist economy, since consumers have hard budget constraints, but they would have scarcely any effect on the sphere

[1]It is perhaps worth adding here that most models of the Barro–Grossman type do not investigate the second property very fully. An interesting micro-model which does investigate the dynamics of fix-price equilibria is given in Picard (1983).

of production; since any resources released in consumption would be absorbed by producers in such a way as to maintain the established degree of shortage. This at least appears to be the logic of Kornai's position, though the apparent implication that shortage cannot be overcome is hard to accept.

The principal positive policy implication from *Economics of Shortage* is that if we wish to abolish shortage, then agents (principally enterprises) have to be convinced that shortage will not occur. Then the formal models will immediately, and with no real change in the underlying economic conditions, generate and reproduce an equilibrium without shortage. The difficulty in practice, of course, would be to convince agents that anything at all had changed given their long previous experience of shortage. In any case, this is surely not a very plausible story as it stands. So we must seek factors more fundamental than agents' expectations as the basis for policy action. Suitable factors were already alluded to above, namely quantity drive and soft budgets, and these we shall discuss further below. The essential point, however, is that a real change in firms' expectations may only be achievable as a result of a quite fundamental economic reform involving both policy instruments and the institutional structure of the economy. Thus a careful consideration of Kornai's approach makes clear that its implications are far more radical than those of the constrained equilibrium school.

3.6.2 The soft budget constraint

In the previous subsection it was argued that the notions of quantity drive and soft budget constraint were not modelled satisfactorily in *Economics of Shortage* and hence that, after all, we still lack a convincing formalization of the theory of shortage. Section 3.3.6 reviewed Kornai's original arguments about soft budget constraints, which have since been refined and developed, though without fundamental change, in Kornai (1986). The arguments have also been discussed, with some critical comment, in Soos (1984), Gomulka (1985) and Szabó (1985). The object of this section is to review these contributions and to assess the present state of the debate about budget constraints of the firm.

The idea of a soft budget constraint explains both too little and too much: too little because, as Gomulka points out, it is not easy to find a firm with a budget constraint that is not at least partly soft, and yet one does not observe shortage everywhere; and too much because the implied quantity drive is neither as universal nor as strong as Kornai has claimed. The first point suggests that it may only be certain aspects or features of soft budget constraints which are essential in the generation of shortage, while the second indicates that these constraints may be an oversimplification of a much more complex institutional environment for the traditional socialist firm.

As compared with a typical capitalist firm, the key features of socialist enterprises are the lack of entry and exit from the market (hardly any firms allowed to go bankrupt, hardly any new firms established in competition with existing ones), and their insertion into a network of predominantly vertical relationships

with upper levels of the planning and control hierarchy. Far from always generating shortage, Gomulka claims that this aspect of the soft budget constraint results in a loss of efficiency (*X*-inefficiency) which may be substantial, but will be kept within limits by the authorities because of their natural insistence that the economy remain productive. Moreover, shortage may be reduced or eliminated altogether using the price mechanism, provided that enterprises expect a delay between an increase in their costs and an offsetting relaxation in their budget constraint (in Gomulka's terminology, budget flexibility < price flexibility). Kornai is far less hopeful about the efficacy of the price mechanism, of course, except in the sphere of personal consumption. However, logically, Gomulka's argument is surely only correct if the authorities are prepared to entertain the possibility of bankruptcy: for otherwise enterprises would always be able to rely on higher organs to act as lender of last resort, hence undermining the authority of price signals.

Soós is concerned about the generality of the soft-budget constraint concept, as shown in the conditions that were listed in section 3.3.6, for it is not clear that the presence or absence of each of these conditions has the same economic effects, nor which combinations are specially decisive for shortage. To give an example: before 1968, Hungarian enterprises operated in an environment in which credits were relatively easily available, and there was no bankruptcy; since then, at least for some of the period, credit and other financial conditions have appeared to be tighter while bankruptcy was still almost unheard of. Does this mean that enterprise budget constraints became softer? Has the economy's tendency to generate shortage diminished? The evidence is actually quite mixed in this respect. The point, however, is that the different conditions listed in section 3.3.6 are not merely variations on a theme. They are different in the sense that they are brought about by different institutional arrangements within the system, one or more could be changed without changing others and they are likely to have different effects. It is therefore important to analyse these conditions separately, especially from the point of view of policy-makers seeking advice on how they might eliminate shortage.

A further puzzling issue in the analysis of shortage, which cuts across the budget constraint problem, is the following. If firms experience an increase in demand, it is accepted that they will normally, perhaps with a lag, adjust by seeking to increase supply. Hence in order to explain persistent shortage, it has to be shown that these increases in supply will always be less than the initial increase in demand; in other words, that supply is relatively inflexible. Otherwise, supply adjustments would eventually catch up with demand and eliminate the shortage. Soós argues that inflexible prices and the institutionalized inelasticity of supply are the key explanatory variables here. Firms have an interest in preserving shortage because it makes life easy, so there is a lack of motivation to adjust, especially in the presence of a soft budget constraint.

Although I suspect that Kornai would accept the above point, his own analysis leads to a formal model of shortage in which friction is apparently zero (section 3.3.7). Indeed friction is not even discussed in his book until after the main analysis

of shortage, though it does play an important part in the later analysis. Yet as Szabó quite rightly emphasizes, if there is no friction it is hard to see how the required inflexibility of supply can be explained and therefore unclear how Kornai is able to justify his view of demand constantly outstripping supply. While the soft budget constraint allows socialist firms to behave in ways that differ from their profit-maximizing capitalist counterparts, it is certainly not enough to explain shortage. We shall have more to say about friction in section 3.7.

Aside from these theoretical points, what is the evidence for soft budget constraints? In Kornai (1986) some results are presented on the relationships between enterprise profits, fiscal redistribution of profits (taxes and subsidies) and enterprise investment in Hungarian state-owned enterprises (of which there were 1755 in 1982); these results are based on Kornai and Matits (1983) and Matits (1984). The evidence shows that there is a strong tendency to redistribute profits from 'the strong to the weak', and the correlation between original profits and final profits (after taxes and subsidies) was practically zero in 1982. Of course, even the data for original profits has to be regarded as suspect from an economic point of view, because of distortions in the price system. Nevertheless, the negligible reported correlation is a striking result. Equally striking is the additional finding that investment activity by firms is hardly correlated with their profitablity in earlier years, again suggesting that the state will help out firms which manage to get permission to undertake investment, irrespective of their profitability.

These observations are said to demonstrate that enterprise budget constraints, even in post-reform Hungary, are indeed soft: but is this a correct interpretation of the results? In my view, the situation is a good deal more complex than Kornai suggests.

First, the observed relationships, with the obviously highly differentiated tax and subsidy system, show one way in which enterprises in Hungary continue to be part of an administrative hierarchy. There are vertical channels other than this financial one, and in this respect Hungary remains close to the traditional centrally planned economy. Secondly, if firms really have soft budget constraints in Kornai's sense, it is not obvious that any particular significance can be attached to profits before or after tax; all we are entitled to conclude is that firms experience considerable financial intervention. Thirdly, being *ex post* magnitudes the reported figures tell us nothing directly about quantity drive: however, it is curious to say the least that the redistribution works as it does (giving additional resources to weaker firms, taking from the more profitable) if quantity drive is the fundamental urge of all enterprises, unless some other more rational allocation principle is also operating in the background. Fourthly, and in support of the last point, even if each individual enterprise perceives that it has a soft budget constraint, for the sphere of production as a whole this is clearly not correct, because an overall real resource constraint comes into effect. Hence, to the extent that enterprise behaviour is influenced by their expectations about the prevailing aggregate and individual constraints, both must be taken into account in any modelling exercise. Furthermore, one way of regarding the reallocation that occurs is as a means of ensuring that enterprises

possess the resources allowing them to develop in a reasonably balanced way. True, the tax/subsidy system that achieves this is absurdly complex, but in a system where prices don't matter very much and may be quite irrational and where there is an emphasis on planning in quantitative terms, it is not an implausible story. Hence rather than supporting the notion of a soft budget constraint, Kornai's observations may merely reflect the prevailing irrationality of the price system.

What remains of the soft budget constraint concept is its origin in the institutional structure within which enterprises operate: a vertically oriented hierarchy (in which a system of sectoral priorities plays an important role in resource allocation), with no bankruptcy for the individual firm, and almost no entry of new firms into an established branch. These are the key features of Eastern European economies which give rise to the behaviour discussed by Kornai. In the next section of this chapter we discuss an alternative approach to modelling these factors.

3.6.3 Measurement of shortage

This topic arose earlier, including in section 3.5, where it was emphasized that shortage should be regarded as a vector quantity, $\mathbf{Z} = (Z_1, \ldots Z_N)$, that it should not be confused with Walrasian excess demand, and that slack indicators, $q = (q_1, \ldots q_m)$ should be measured separately, rather than being merged into the measure of shortage by means of aggregation. Finally, section 3.3.8 reviewed the fundamental inverse relationship between shortage intensity $\eta = f(Z)$, slack $\lambda = g(q)$ and some measure of fraction, ε, in particular markets (Fig. 3.1).

In practice, the injunction against aggregation has not prevented Kornai himself from engaging in it when convenient and appropriate, as for instance in the growth model of section 3.4. However, he has not tended to combine Z and q. On the other hand, in view of the relationship between η and λ just mentioned, it is hard to see why one should not aggregate, unless there is some reason to expect the degree of friction in the economy to change significantly over the period being studied. For any relationship involving both η and λ obviously reduces to one in η alone with an appropriate change of functional form. Hence in the present discussion, we lose very little by concentrating on shortage.

To measure shortage in a particular market we have to identify a suitable list of partial indicators, Z, concerning the actual market situation; to study the behaviour of the market, it is also important to measure normal shortage. The latter can either be done in terms of the same list of indicators or, more likely, in terms of the shortage intensity, $\eta = f(Z)$. In this case, the correct way of combining components of Z into a single measure is itself a matter for empirical estimation. η has to be a function of the partial indicators, but it must also have behavioural significance in that firms (and possibly households, and government agencies) react to the deviation $(\eta - \eta^*)$, where η^* is the required normal shortage. It is perhaps pertinent to point out here that Kornai himself provides little guidance on the measurement of normal shortage.

Most partial indicators that are readily measureable lack an unambiguous interpretation. For instance, for a product purchased by households we should try to measure the quantities (same notation as earlier):

$$Z_h = \max [X_h - \bar{X}_h, 0] \tag{3.22}$$

However, when we do so it is unavoidably necessary to aggregate over households to some degree and the X_h that is observable is unlikely to be the unconstrained, Walrasian demand, but is almost certainly influenced by forced substitution into or away from the market being studied. Hence depending on the situation in related markets, X_h may under- or overestimate the true demand in the given market, and the need to aggregate also loses some information. Both factors mean that Z_h as measured in Equation 3.22 can change when the underlying shortage conditions are unchanged; equally, Z_h can remain constant while shortage really is changing. Consequently without a well-specified model which includes an explanation of the process generating the observations, Z_h, and hence imposes a well-defined, 'correct' interpretation, it is impossible to measure shortage satisfactorily.

A further point on measurement, one recognized by Kornai to some extent, is that even for a market that one would not wish to characterize as a market with shortage, measured shortage (Z or η) would normally not be zero. In terms of Fig. 3.1, such an outcome would be represented by a point towards the bottom right of the diagram (low η, high λ). Presumably, however, the normal shortage, η^* should be zero (or very close to zero) in such cases, so that agents would behave as if they did not expect to encounter shortage in the normal course of events (in line with Hahn's (1973a) view of agents forming theories about the economy in which they operate). What is unknown, without detailed empirical study, is how often and with what intensity agents can experience shortage before changing their theory of the economy.

3.7 AN ALTERNATIVE MODEL

Some of the key points in *Economics of Shortage* can be accommodated in the following rather simple model, which shows that under the conditions held by Kornai to characterize the socialist economies, shortage is more likely to occur than it would in competitive capitalism. In general terms, a set of input–output balances for an economy can be written in the form:

$$\mathbf{X} = A\mathbf{X} + \mathbf{y} + \mathbf{f} \tag{3.23}$$

where

$\mathbf{X}$ = vector of gross output
$\mathbf{y}$ = vector of final demand (consumption plus investment plus government spending plus net exports)
A = matrix of technical input coefficients

} All this is the standard terminology and notation of input–output analysis

$\mathbf{f}$ = vector of resources absorbed by adjustment frictions in the economy

In Equation 3.23, although it is a static model, it is perhaps best to think of **f** as a measure of the costs of getting from last year's allocation of resources to the current year's. This is, of course, an extremely crude way of representing friction, but it does at least recognize that the operation of any resource allocation mechanism (including a supposedly perfect market) absorbs real resources. It contrasts with standard accounts of perfect markets in which the costs of transmitting, receiving and processing economically relevant signals are wholly ignored.

An equation such as 3.23 holds for any economy. From the arguments in *Economics of Shortage* we can conclude that in a socialist economy, the lack of competition (no bankruptcy, hardly any new entry, import controls) allows current costs to be higher than they would otherwise be, while adjustment frictions are likely to be higher too, partly for lack of proper incentives, partly due to distorted prices and partly due to the complexity of the administrative structure through which adjustments are implemented. These differences can be modelled by assuming

$$A_s > A_c \quad \text{and} \quad f_s > f_c \tag{3.24}$$

where the suffix, s, refers to a socialist economy, and c refers to a capitalist one.

Suppose the capitalist and socialist economies being compared both possess the same capacities in each industry; let the common capacity vector be **k**. In addition, suppose both economies aim to produce the same final demand vector, **y**. Then for the capitalist economy,

$$X_c = \min (A_c X_c + \mathbf{y} + f_c, \mathbf{k}) \tag{3.25}$$

and for the socialist economy,

$$X_s = \min (A_s X_s + \mathbf{y} + f_s, \mathbf{k}) \tag{3.26}$$

both equations taking account of capacity constraints. If some capacity constraints are binding, then the actually produced final output will be less than **y** in some components:

$$y_c = (I - A_c)X_c - f_c \leqq \mathbf{y} \tag{3.27}$$

and

$$y_s = (I - A_s)X_s - f_s \leqq \mathbf{y} \tag{3.28}$$

If **y** is set at a level which is just feasible for the capitalist economy ($y_c = \mathbf{y}$ in 3.27), it follows from Equations 3.24 and 3.28 that $y_s < y_c$, so that the corresponding socialist economy will experience general shortage. Hence, given higher production costs and higher adjustment frictions, the socialist economy is substantially more prone to shortage, just as Kornai has argued. However, this argument took it for granted that the socialist economy would seek to achieve the same output vector as its capitalist equivalent, making no allowance at the planning stage for higher input costs and losses due to friction. To this extent, one could equally well attribute the shortage that results under socialism to over-ambitious planning. Or alternatively, this approach reinstates Kornai's view by requiring some form of quantity drive to make the model work.

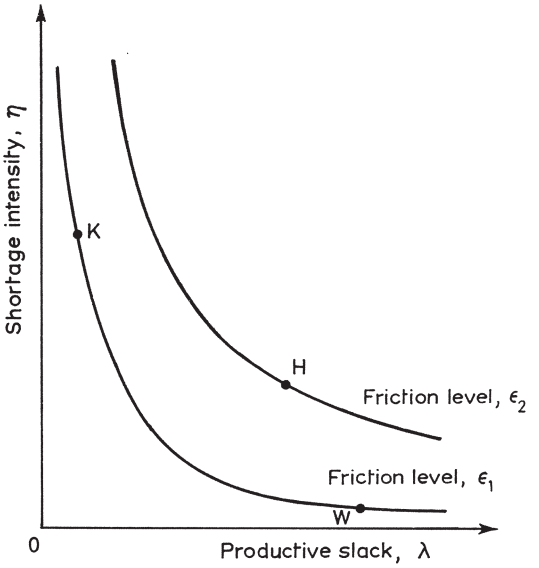

Fig. 3.2 Alternative states of the economy: friction, slack and shortage. W = Walrasian equilibrium, K = Kornai's shortage economy, H = Hare's economy with adjustment friction.

At this point it is convenient to return to Fig. 3.1 which is reproduced as Fig. 3.2, together with some additional information. Three points are shown in the diagram. W is essentially a Walrasian equilibrium, with negligible or small intensity of shortage and relatively large productive slack (strictly, O is the Walrasian equilibrium, but as pointed out earlier such an outcome is impossible). K represents Kornai's view of an economy with shortage; η is large, λ is small so that for a given level of friction in the economy we simply move along the friction function. Finally, H is the present author's view of an economy with shortage: as compared with the competitive economy it is characterized by a higher level of adjustment friction.

We now seem to have a story of shortage in which lack of competition and higher adjustment friction – and quantity drive – are jointly sufficient to explain shortage in a socialist economy. Moreover, the factors emphasized here are not only consistent with much of Kornai's argument, but also have the virtue of setting out before us a clear agenda for further work: both in modelling their effects on the economy, and in identifying the kinds of economic reform that might allow shortage to be overcome.

3.8 CONCLUDING OBSERVATIONS

This chapter has reviewed Kornai's important contribution to the study of Eastern European economies, noting his rigorous analytical approach and his willingness to

overturn traditional dogmas. However, this review has encountered a number of lacunae in his theory. This concluding section briefly summarizes our main findings. For simplicity, I merely list the key points.

1. Despite the attention quite properly given to the notions of expansion drive, quantity drive and soft budget constraint, these are not formally modelled in *Economics of Shortage* or in other work by Kornai and his research group;
2. The concept of control by norms enables models to be developed in which the reproduction of shortage is explained through a feedback mechanism based on agents' expectations. However, the formal analysis does not explain why or how a particular intensity of shortage comes to be established as the norm under given conditions, though Kornai's descriptive theorizing does draw attention to the relevant historical and institutional factors.
3. Kornai lays considerable emphasis on adjustment frictions in the economy, including the fundamental relationships of the form, $\eta = \phi(\lambda, \varepsilon)$, yet his models of control by norms are entirely frictionless, as is much of the discussion of shortage. Again, however, his descriptive analysis gives friction its proper place in the story;
4. The measurement of shortage in the presence of adjustment frictions implies that it will never be zero. But not all economies develop feedback control mechanisms based on a deviation between actual and normal shortage. It is not apparent from Kornai's analysis under what conditions such a mechanism can emerge and persist (this is analogous to the occurrence of a particular equilibrium regime in the Barro–Grossman story). Consequently, it is not clear that we are entitled to conclude that centrally planned economies will always experience shortage in this sense;
5. In seeking to develop a theory of shortage in terms of rational behaviour by individual agents (principally households and firms), Kornai quite correctly wishes to avoid explanations based on planners' errors or overambition. However, the cost of this approach is a neglect of the role played by the vertical planning hierarchy in guiding the economy (and hence, among other things, in generating shortage), except where it impinges directly on the enterprise. Although horizontal information flows, and the vegetative control they make possible, suffice to explain the reproduction of shortage (see point 2 above, as well as section 3.3.7), they do not explain its normal intensity, as Kornai does indeed recognize;
6. To explain the latter, one would have to appeal to a variety of historical and institutional factors going back to the origins of the centrally planned economic systems in Eastern Europe;
7. Finally, to eliminate, or significantly reduce the degree of shortage experienced in Eastern Europe, requires major reforms of the economic management structure; it would not be sufficient merely to correct distortions in the structure of relative prices.

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